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DEPARTMENT OF ECOLOGY
EASTERN REGIONAL OFFICE

March 13, 1998
Project No: 624419

Mr. Guy Gregory
Washington Department of Ecology
N. 4601 Monroe, Suite 100
Spokane, Washington 99205-1295

SUBJECT: RESPONSE TO ECOLOGY'S COMMENTS PASCO LANDFILL PHASE II RI REPORT

Dear Mr. Gregory:

Please find enclosed the FINAL Phase II Remedial Investigation (RI) report for the Pasco Landfill Site. This document has been prepared by Philip Environmental Services (Philip) on behalf of the Pasco Landfill Potentially Liable Person Group (PLP Group) in accordance with the requirements of Enforcement Order No. DE 94TC-E103, Exhibit C and amendments. For clarity I have provided the following itemized responses to your letters dated August 1, 1997 and September 24, 1997 which contain Ecology's comments concerning the Phase II Remedial Investigation (RI) Report, Response to Ecology Comments document and the Phase II RI Supplement.

Phase II RI Response to Ecology Comments

1. Reply to Response 2

   Ecology is critical of the Fenn et a. 1975 water balance as being out of date and of limited utility. Ecology believes understanding infiltration to be key to evaluating the site. Instead of deleting the paragraph, please expand the evaluation to include additional estimates from published studies of more local conditions.

   Response:

   Section 1.2.4 of the Phase II RI report has been expanded to include the results of additional studies performed by Gephart et al. (1979), Dincola (1997), and Bauer and Viccaro (1990). Gephart et al. (1979) utilized numerical modeling to predict the hydrologic budget for the Pasco Basin. Based on an estimated area of 1,200,000 acres for the Pasco Basin, the results of the numerical model indicated that of 7.56 inches (756,000 acre-feet) of annual precipitation, 7.50 inches (750,000 acre feet) were removed through evapotranspiration leaving only 0.06 inches (6,000 acre-feet) available for infiltration.

   Similarly, numerical modeling performed by Dincola (1997) using 36 years of hydraulic data for the Cold Creek and Dry Creek Basins located on the Hanford Site (located approximately

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40 miles from the site), indicated an average of approximately 0.1 inches of recharge from runoff annually.

Bauer and Viccaro (1990) employed the deep percolation model, which utilizes daily temperature, soil type, evapo-transpiration, precipitation, and other climatological data to produce time-averaged estimates of recharge from infiltration of precipitation. This use of daily measurements for estimating infiltration can be significant in arid regions, such as the Pasco Basin, where precipitation is infrequent and resulted in somewhat higher estimates of annual recharge rates; approximately 0.3 inches per year as compared with estimates of 0.1 per year or less from studies using annual or monthly data.

Section 1.2.4 of the Phase II RI Report has been revised as follows:

1.2.4 REGIONAL HYDROGEOLOGY

Regional aquifers in this part of the Columbia Basin are present in the Columbia River Basalt Group and the unconsolidated deposits. The Columbia River Basalt Group is the principal aquifer of the Columbia Plateau, consisting of a thick sequence of flood basalts with associated interbedded sedimentary layers. The thickness of the basalt sequence exceeds 11,000 feet in some areas of the basin.

Individual basalt flows within the sequence range in thickness from 20 to 100 feet with water occurring in zones along the tops and bottoms of the flow zones. Irrigation wells that penetrate multiple interflow zones in the basalt aquifer are often capable of producing water at rates from 1,000 to 2,500 gallons per minute (gpm).

Many basalt flows are interbedded with fine-grained sedimentary deposits. These interbeds often exhibit low permeability and retard the movement of water between interflow zones. The vertical permeability through the basalt flows is generally lower than the horizontal permeability. The transmissivity in the region has been reported to range from 500 to 7,400 square feet per day (ft^2/d), averaging about 2,600 ft^2/d (Tanaka and others, 1974).

Stratified clay, silt, sand, and gravel of the Ringold Formation and glaciofluvial deposits of the Hanford Formation overlie the basalt over much of the region. Loess deposits may also overlie the basalt, but when present are usually thin. Where the saturated thickness of the glaciofluvial deposits is great, high yields of water can be expected. Well yields from 10 to 1,000 gpm are reported for the Ringold Formation, while well yields from 100 to 4,000 gpm have been reported for the glaciofluvial sands and gravels. Silt content often limits the yield of wells in the Ringold Formation; however, in the vicinity of the site, higher yields can occur due to the presence of thicker, coarse-grained glaciofluvial deposits in the Pasco syncline.

The hydraulic conductivity of the Ringold Formation has been reported to range from 0.007 to 0.21 centimeters per second (cm/s), and that of the glaciofluvial deposits has been reported to range from 0.18 to 7.0 cm/s (U.S. Department of Energy, 1979).

The primary source of recharge water to the confined aquifers of the Columbia River Basalt Group is precipitation in the northeast areas of the Columbia Plateau where precipitation exceeds 18 inches annually, compared to about 7 inches at the site. Regional groundwater east of the Columbia River flows to the southwest, following topography and discharges along the Columbia and Snake Rivers (Widness, 1986). The unconfined aquifer in the Ringold Formation and the glaciofluvial deposits are also recharged from the precipitation in the higher elevations surrounding the Pasco Basin, as well as downward percolation from the tributaries that originate in the hills and mountains (U.S. Department of Energy, 1979).

Direct recharge of the unconfined aquifer also occurs in agricultural areas through the infiltration of irrigation water. The U.S. Bureau of Reclamation (1971) has estimated that 20 to 40 percent of irrigation water reaches the water table during periods of prolonged irrigation. Similarly, Bauer and Viccaro (1990) calculated that from an estimated 23.7 inches of irrigation water applied to agricultural areas in the Pasco Basin annually, approximately 12 inches reach the regional aquifer system through direct infiltration.

However, the results of water balance studies of the region indicate that infiltration of rainfall does not contribute appreciably to recharge of the aquifer on an annual basis. Numerical modeling of 36 years of hydraulic data for the Cold Creek and Dry Creek Basins on the Hanford Site (Dincola 1997) (located approximately 40 miles from the site), indicated an average of approximately 0.1 inches of recharge from runoff annually. The results of a water balance model prepared for the region by Fenn et al. (1975) indicated that on a net monthly basis no free water from infiltration of precipitation was available for recharge to the aquifer. Similarly, based on an estimated area of 1,200,000 acres for the Pasco Basin, numeric modeling of the basin's hydrologic budget by Gephart et al. (1979) indicated that of 7.56 inches (756,000 acre-feet) of annual precipitation, 7.50 inches (750,000 acre feet) were removed through evapotranspiration leaving only 0.06 inches (6,000 acre-feet) available for infiltration. Bauer and Viccaro (1990) calculated slightly higher rates for recharge, with values ranging between 0.3 and 0.5 inches annually for undeveloped (non-irrigated) portions of the Pasco Basin. Bauer and Viccaro employed the deep percolation model, which utilizes daily temperature, soil type, evapo-transpiration, precipitation, and other climatological data to produce time-averaged estimates of recharge from infiltration of precipitation. This use of daily measurements for estimating infiltration can be significant in arid regions, such as the Pasco Basin, where precipitation is infrequent and may account for the higher estimates of annual recharge rates calculated in this study.

Additional details concerning the regional hydrogeology of the Pasco Landfill site and surrounding area are provided in the Phase I RI Report (Burlington Environmental, 1994).

2. Reply to Response 5

   Please explain the source of the "average" columns on Table 1.

   Response:

   For clarity, the word "Average" has been changed to "Arithmetic Mean" on all relevant tables.

3. Reply to Response 14

   Ecology does not necessarily agree that "variability in detection and concentration" of metals analyses indicate their presence to be clearly "not the result of site activities".

   Response:

   To date, analysis of metals data collected from the background wells and wells associated with the individual waste units has not indicated waste handling activities at the site as the source of metals in groundwater. However, additional statistical analyses of the metals data has been included as part of the Risk Assessment/Cleanup Levels Analysis currently being developed for the site. The results of these statistical analyses should provide additional insight into the determination of site background concentrations for metals in groundwater.

4. Reply to Response 19

   Ecology will continue to evaluate these data. This (the source of VOCs in well 27S) is a complex situation, and if we have additional comment, we will present it in our review of the supplemental RI.

   Response:

   Please refer to the response to Comment 5 of the Phase II RI Supplement, below.

Phase II RI Supplement

1. Section 3.1

   Comment:

   Only Figure 3.3 was included in our copies. There is a benefit to updating this site's longitudinal cross-section to include off-site wells.

   Response:

   All of the offsite wells installed down gradient from the site were completed in the uppermost portion of the Upper Pasco Gravels and provide little additional stratigraphic information. other than the thickness of the Touche Beds at each location. This data did not provide any significant additional insight relevant to site characterization or potential remedial alternatives and as a result the geologic cross-sections were not extended.

2. Section 3.4.1, Page 3-13, first paragraph

   Comment:

   "Figure 73" should be "Figure 3-73"

   Response:

   The compilation of a single FINAL Phase II RI Report from the DRAFT Phase II RI, the Response to Ecology Comments, and the RI Supplement renumbering of the figures from was necessary. All figures included in the FINAL Phase II RI report (including the above referenced figure) have been renumbered as appropriate.

3. Page 3-20

   Comment:

   Ketone distribution is discussed for off-site wells, not Zone C and D wells.

   Response:

   Section 3.7.4.1 of the Phase II RI report has been revised to include a discussion of the range and distribution of all VOCs (including ketones) which were detected in the Zone C and D Wells.

4. Tables

   Comment:

   Please provide updated electronic files containing all Phase II water quality data.

   Response:

   Electronic files containing Phase II water quality data collected between July 1996 and December 1997 will be included as part of the 1997 Annual Report for the site.

5. Figure 3-36

   Comment:

   This illustrates Ecology's understanding of the VOC distribution on the site. In general, a plume seems to emanate form Zone A, centering on the EE-3/MW-12S axis. This plume is evident for most volatile organic chemicals detected during the Phase II RI. A second plume seems to emanate from the Municipal landfill, in the vicinity of MW-16S and #4. This plume, in these maps, is present for TCE (and) PCE, see figure 3-28, for example). These two plumes are perhaps best illustrated for the vinyl chloride figures. Ecology concurs with the general conclusion within the text of section 3.4 that these plumes seem to coalesce downgradient of the site. That conclusion is legitimate, given the density of monitoring points and the purposes of the study.

   Ecology also believes the MSW may be the source of several "plumes".

   More problematic is the occurrence of VOCs in the interior of the site. Philip contour maps illustrate a feature, which I'll refer to as the "Well 8 reentrant". This feature is an area of *relatively low concentrations of various chemical, though the magnitude changes, (are) perhaps best illustrated on maps showing the distribution of TCE. This feature is controlled largely by detections of chemicals in wells EE-7 and EE-8, MW-18S and MW-14S (note: it appears that in this statement Ecology has incorrectly identified MW-19S as MW-14S). Ecology and Philip early on suspected Zone E as the most obvious waste management unit immediately upgradient from this area as the source for these detections, and gathered data accordingly. Philip's conclusion is that Zone E is not a potential source of VOCs, and that detections in Zone E wells and presumably MW-19S are related to the municipal landfill. Ecology has reservations with a Municipal Landfill source for these chemicals, based upon lack of a good mechanism to date which explains both the increased levels, generally speaking, of some chemicals in MW-19S and MW-27S, and decreased levels of chemicals in the Well 8 reentrant.*

Philip's conclusion is well founded, illustrated by figures in this document showing the distribution of PCE. Ecology's are perhaps, best illustrated by the maps illustrating the distribution of 1,1-DCE. In these figures, concentrations in Well MW-19S are associated with Zone A wells, (see figure 3-53) not with Well 9 as in other figures.

Has Philip a mechanism to explain the occurrence of the Well 8 reentrant?

Response:

Section 3.6.4.1 of the Phase II RI Report contains a detailed analysis of the distribution, frequency of detection, and range of concentrations of VOCs observed in the Zone E Wells EE-8, MW-19S, and MW-27S, background wells MW-20S, MW-28S, and NW-5, and Landfill Well #9. The results of this analysis suggest that the waste in Zone E is not acting as a source of VOCs in groundwater beneath Zone E. With respect to the Well 8 reentrant, the source of this phenomenon is unclear.

Per your request we have provided seven copies of the above referenced document for your distribution. Please contact me at (425) 227-6157 with any questions.

Sincerely,

PHILIP ENVIRONMENTAL SERVICES CORPORATION

David R. Provance
Asst. Project Manager

cc: PLP Group Technical Committee
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